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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/080,488	02/22/2002	Henry Esmond Butterworth	GB919990129US1	8490

7590

04/26/2005

Brian C. Kunzler  
10 West 100 South  
Salt Lake City, UT 84101



EXAMINER

BRAGDON, REGINALD GLENWOOD

ART UNIT PAPER NUMBER

2188

DATE MAILED: 04/26/2005

## Determination of Patent Term Adjustment under 35 U.S.C. 154 (b)

(application filed on or after May 29, 2000)

The Patent Term Adjustment to date is 318 day(s). If the issue fee is paid on the date that is three months after the mailing date of this notice and the patent issues on the Tuesday before the date that is 28 weeks (six and a half months) after the mailing date of this notice, the Patent Term Adjustment will be 318 day(s).

If a Continued Prosecution Application (CPA) was filed in the above-identified application, the filing date that determines Patent Term Adjustment is the filing date of the most recent CPA.

Applicant will be able to obtain more detailed information by accessing the Patent Application Information Retrieval (PAIR) WEB site (<http://pair.uspto.gov>).

Any questions regarding the Patent Term Extension or Adjustment determination should be directed to the Office of Patent Legal Administration at (571) 272-7702. Questions relating to issue and publication fee payments should be directed to the Customer Service Center of the Office of Patent Publication at (703) 305-8283.

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## PART B - FEE(S) TRANSMITTAL

Complete and send this form, together with applicable fee(s), to: Mail

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 Commissioner for Patents  
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 or Fax (703) 746-4000

INSTRUCTIONS: This form should be used for transmitting the ISSUE FEE and PUBLICATION FEE (if required). Blocks 1 through 5 should be completed where applicable. All further correspondence including the Patent, advance orders and notification of maintenance fees will be mailed to the current correspondence address as indicated unless corrected below or directed otherwise in Block 1, by (a) specifying a new correspondence address; and/or (b) indicating a separate "FEE ADDRESS" for maintenance fee notifications.

CURRENT CORRESPONDENCE ADDRESS (Note: Use Block 1 for any change of address)

7590

04/26/2005

Brian C. Kunzler  
 10 West 100 South  
 Salt Lake City, UT 84101

Note: A certificate of mailing can only be used for domestic mailings of the Fee(s) Transmittal. This certificate cannot be used for any other accompanying papers. Each additional paper, such as an assignment or formal drawing, must have its own certificate of mailing or transmission.

## Certificate of Mailing or Transmission

I hereby certify that this Fee(s) Transmittal is being deposited with the United States Postal Service with sufficient postage for first class mail in an envelope addressed to the Mail Stop ISSUE FEE address above, or being facsimile transmitted to the USPTO (703) 746-4000, on the date indicated below.

(Depositor's name)
(Signature)
(Date)

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/080,488	02/22/2002	Henry Esmond Butterworth	GB919990129US1	8490

TITLE OF INVENTION: LOG-STRUCTURE ARRAY

APPLN. TYPE	SMALL ENTITY	ISSUE FEE	PUBLICATION FEE	TOTAL FEE(S) DUE	DATE DUE
nonprovisional	NO	\$1400	\$300	\$1700	07/26/2005

EXAMINER	ART UNIT	CLASS-SUBCLASS
BRAGDON, REGINALD GLENWOOD	2188	711-114000

1. Change of correspondence address or indication of "Fee Address" (37 CFR 1.363).

- ☐ Change of correspondence address (or Change of Correspondence Address form PTO/SB/122) attached.
- ☐ "Fee Address" indication (or "Fee Address" Indication form PTO/SB/47; Rev 03-02 or more recent) attached. Use of a Customer Number is required.

2. For printing on the patent front page, list

- (1) the names of up to 3 registered patent attorneys or agents OR, alternatively,
- (2) the name of a single firm (having as a member a registered attorney or agent) and the names of up to 2 registered patent attorneys or agents. If no name is listed, no name will be printed.

1 \_\_\_\_\_

2 \_\_\_\_\_

3 \_\_\_\_\_

3. ASSIGNEE NAME AND RESIDENCE DATA TO BE PRINTED ON THE PATENT (print or type)

PLEASE NOTE: Unless an assignee is identified below, no assignee data will appear on the patent. If an assignee is identified below, the document has been filed for recordation as set forth in 37 CFR 3.11. Completion of this form is NOT a substitute for filing an assignment.

(A) NAME OF ASSIGNEE

(B) RESIDENCE: (CITY and STATE OR COUNTRY)

Please check the appropriate assignee category or categories (will not be printed on the patent): ☐ Individual ☐ Corporation or other private group entity ☐ Government

4a. The following fee(s) are enclosed:

- ☐ Issue Fee
- ☐ Publication Fee (No small entity discount permitted)
- ☐ Advance Order - # of Copies \_\_\_\_\_

4b. Payment of Fee(s):

- ☐ A check in the amount of the fee(s) is enclosed.
- ☐ Payment by credit card. Form PTO-2038 is attached.
- ☐ The Director is hereby authorized by charge the required fee(s), or credit any overpayment, to Deposit Account Number \_\_\_\_\_ (enclose an extra copy of this form).

5. Change in Entity Status (from status indicated above)

- ☐ a. Applicant claims SMALL ENTITY status. See 37 CFR 1.27. ☐ b. Applicant is no longer claiming SMALL ENTITY status. See 37 CFR 1.27(g)(2).

The Director of the USPTO is requested to apply the Issue Fee and Publication Fee (if any) or to re-apply any previously paid issue fee to the application identified above. NOTE: The Issue Fee and Publication Fee (if required) will not be accepted from anyone other than the applicant; a registered attorney or agent; or the assignee or other party in interest as shown by the records of the United States Patent and Trademark Office.

Authorized Signature \_\_\_\_\_

Date \_\_\_\_\_

Typed or printed name \_\_\_\_\_

Registration No. \_\_\_\_\_

This collection of information is required by 37 CFR 1.311. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.14. This collection is estimated to take 12 minutes to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, Virginia 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, Virginia 22313-1450.

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## NOTICE OF ALLOWANCE AND FEE(S) DUE

7590 04/26/2005  
Brian C. Kunzler  
10 West 100 South  
Salt Lake City, UT 84101



EXAMINER

BRAGDON, REGINALD GLENWOOD

ART UNIT PAPER NUMBER

2188

DATE MAILED: 04/26/2005

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/080,488	02/22/2002	Henry Esmond Butterworth	GB919990129US1	8490

TITLE OF INVENTION: LOG-STRUCTURE ARRAY

APPLN. TYPE	SMALL ENTITY	ISSUE FEE	PUBLICATION FEE	TOTAL FEE(S) DUE	DATE DUE
nonprovisional	NO	\$1400	\$300	\$1700	07/26/2005

THE APPLICATION IDENTIFIED ABOVE HAS BEEN EXAMINED AND IS ALLOWED FOR ISSUANCE AS A PATENT. **PROSECUTION ON THE MERITS IS CLOSED.** THIS NOTICE OF ALLOWANCE IS NOT A GRANT OF PATENT RIGHTS. THIS APPLICATION IS SUBJECT TO WITHDRAWAL FROM ISSUE AT THE INITIATIVE OF THE OFFICE OR UPON PETITION BY THE APPLICANT. SEE 37 CFR 1.313 AND MPEP 1308.

THE ISSUE FEE AND PUBLICATION FEE (IF REQUIRED) MUST BE PAID WITHIN THREE MONTHS FROM THE MAILING DATE OF THIS NOTICE OR THIS APPLICATION SHALL BE REGARDED AS ABANDONED. **THIS STATUTORY PERIOD CANNOT BE EXTENDED.** SEE 35 U.S.C. 151. THE ISSUE FEE DUE INDICATED ABOVE REFLECTS A CREDIT FOR ANY PREVIOUSLY PAID ISSUE FEE APPLIED IN THIS APPLICATION. THE PTOL-85B (OR AN EQUIVALENT) MUST BE RETURNED WITHIN THIS PERIOD EVEN IF NO FEE IS DUE OR THE APPLICATION WILL BE REGARDED AS ABANDONED.

### HOW TO REPLY TO THIS NOTICE:

#### I. Review the SMALL ENTITY status shown above.

If the SMALL ENTITY is shown as YES, verify your current SMALL ENTITY status:

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B. If the status above is to be removed, check box 5b on Part B - Fee(s) Transmittal and pay the PUBLICATION FEE (if required) and twice the amount of the ISSUE FEE shown above, or

If the SMALL ENTITY is shown as NO:

A. Pay TOTAL FEE(S) DUE shown above, or

B. If applicant claimed SMALL ENTITY status before, or is now claiming SMALL ENTITY status, check box 5a on Part B - Fee(s) Transmittal and pay the PUBLICATION FEE (if required) and 1/2 the ISSUE FEE shown above.

II. PART B - FEE(S) TRANSMITTAL should be completed and returned to the United States Patent and Trademark Office (USPTO) with your ISSUE FEE and PUBLICATION FEE (if required). Even if the fee(s) have already been paid, Part B - Fee(s) Transmittal should be completed and returned. If you are charging the fee(s) to your deposit account, section "4b" of Part B - Fee(s) Transmittal should be completed and an extra copy of the form should be submitted.

III. All communications regarding this application must give the application number. Please direct all communications prior to issuance to Mail Stop ISSUE FEE unless advised to the contrary.

**IMPORTANT REMINDER:** Utility patents issuing on applications filed on or after Dec. 12, 1980 may require payment of maintenance fees. It is patentee's responsibility to ensure timely payment of maintenance fees when due.



# **Notice of Allowability**

Application No.

10/080,488

Examiner

Reginald G. Bragdon

Applicant(s)

BUTTERWORTH ET AL.

Art Unit

2188

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address--

All claims being allowable, PROSECUTION ON THE MERITS IS (OR REMAINS) CLOSED in this application. If not included herewith (or previously mailed), a Notice of Allowance (PTOL-85) or other appropriate communication will be mailed in due course. **THIS NOTICE OF ALLOWABILITY IS NOT A GRANT OF PATENT RIGHTS.** This application is subject to withdrawal from issue at the initiative of the Office or upon petition by the applicant. See 37 CFR 1.313 and MPEP 1308.

1. ☒ This communication is responsive to the amendment filed 19 July 2004 and the brief filed 08 November 2004.
2. ☒ The allowed claim(s) is/are 1-6, 8, 7, and 9-22, renumbered 1-22.
3. ☒ The drawings filed on 22 February 2002 are accepted by the Examiner.
4. ☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
  - a) ☒ All    b) ☐ Some\*    c) ☐ None    of the:
  1. ☒ Certified copies of the priority documents have been received.
  2. ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.
  3. ☐ Copies of the certified copies of the priority documents have been received in this national stage application from the International Bureau (PCT Rule 17.2(a)).

\* Certified copies not received: \_\_\_\_\_.

Applicant has THREE MONTHS FROM THE "MAILING DATE" of this communication to file a reply complying with the requirements noted below. Failure to timely comply will result in ABANDONMENT of this application.  
**THIS THREE-MONTH PERIOD IS NOT EXTENDABLE.**

5. ☐ A SUBSTITUTE OATH OR DECLARATION must be submitted. Note the attached EXAMINER'S AMENDMENT or NOTICE OF INFORMAL PATENT APPLICATION (PTO-152) which gives reason(s) why the oath or declaration is deficient.
  6. ☐ CORRECTED DRAWINGS ( as "replacement sheets") must be submitted.
    - (a) ☐ including changes required by the Notice of Draftsperson's Patent Drawing Review ( PTO-948) attached
      - 1) ☐ hereto or 2) ☐ to Paper No./Mail Date \_\_\_\_\_.
    - (b) ☐ including changes required by the attached Examiner's Amendment / Comment or in the Office action of Paper No./Mail Date \_\_\_\_\_.
- Identifying indicia such as the application number (see 37 CFR 1.84(c)) should be written on the drawings in the front (not the back) of each sheet. Replacement sheet(s) should be labeled as such in the header according to 37 CFR 1.121(d).
7. ☐ DEPOSIT OF and/or INFORMATION about the deposit of BIOLOGICAL MATERIAL must be submitted. Note the attached Examiner's comment regarding REQUIREMENT FOR THE DEPOSIT OF BIOLOGICAL MATERIAL.

## **Attachment(s)**

1. ☐ Notice of References Cited (PTO-892)
2. ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3. ☐ Information Disclosure Statements (PTO-1449 or PTO/SB/08), Paper No./Mail Date \_\_\_\_\_
4. ☐ Examiner's Comment Regarding Requirement for Deposit of Biological Material
5. ☐ Notice of Informal Patent Application (PTO-152)
6. ☐ Interview Summary (PTO-413), Paper No./Mail Date \_\_\_\_\_
7. ☒ Examiner's Amendment/Comment
8. ☐ Examiner's Statement of Reasons for Allowance
9. ☐ Other \_\_\_\_\_

### **EXAMINER'S AMENDMENT**

1. An examiner's amendment to the record appears below. Should the changes and/or additions be unacceptable to applicant, an amendment may be filed as provided by 37 CFR 1.312. To ensure consideration of such an amendment, it MUST be submitted no later than the payment of the issue fee.
2. This amendment is presented in order to enter the amendment filed by Applicant on 19 July 2004. No changes have been made to content of the amendment to the specification and claims as presented by the Applicant. However, the amendment of 19 July 2004 was not in the proper format in accordance with 37 CFR 1.121(h) in that the amendment to the specification was not on a separate page from the amendment to the claims. In order to enter the amendment of 19 July 2004, the Examiner is presenting this Examiner's amendment incorporating the amendment of 19 July 2004.
3. The application has been amended as follows:

### IN THE SPECIFICATION

Please amend the paragraphs as follows.

On page 19, beginning on line 1.

Destage operations are much simpler since these always occur as full stripe writes. In this case the data and parity are written as the position shown in Fig. 34 and the bitmap is updated if necessary to show that the data and parity have been removed.

### IN THE CLAIMS

1. (Currently Amended) A method of adding an information storage device to a plurality of information storage devices in an information processing system in which a processor is connected for communication with the information storage devices by means of a log structured array (LSA) controller in which the information is stored as a plurality of stripes extending across the plurality of storage devices of the array, the LSA controller further defining a directory which specifies storage locations using relative addresses a construct comprising a stripe number and an offset, the method comprising connecting the additional information storage device to the LSA controller and logically appending an additional strip provided to each existing stripe by the additional storage device to the end of each stripe in the directory.

2. (Original) The method of claim 1, further comprising configuring the plurality of information storage devices as an N+1 array.

3. (Original) The method of claim 1, wherein each stripe comprises N information strips and one parity strip, each information strip storing an integer number of logical tracks.

4. (Previously Amended) The method of claim 1, wherein the directory comprises a LSA directory which specifies the location of a logical track in terms of the ID of the stripe to which the track belongs and the offset of the track within the stripe.

5. (Previously Amended) The method of claim 1, wherein prior to the addition of the

additional storage device, the parity strips are rotated amongst the N+1 information storage devices in accordance with a RAID-5 architecture, the method further comprising moving selected parity strips to the additional information storage device at locations that would have stored parity strips had the array originally comprised N+2 information storage devices.

6. (Original) The method of claim 5, wherein the data and parity strips are moved to the additional storage device during normal IO operations to the devices.

7. (Original) The method of claim 5, wherein a background task is defined by the controller to move the data and parity strips to the additional storage device.

8. (Previously Amended) The method of claim 6, wherein a bitmap is defined by the controller, each bit of the bitmap representing an array stripe and indicating whether the data and parity strips of the stripe are located in their original position or in the position appropriate to the plurality of information storage devices including the additional information storage device .

9. (Original) The method of claim 1, wherein the additional information storage device is initialised to all binary zeros prior to connection to the controller.

10. (Original) The method of claim 1, further comprising connecting a plurality of additional information storage devices to the log-structured array controller and logically appending the additional strips, provided to each existing stripe by the additional storage devices, to the end of each stripe in the LSA directory.

11. (Currently Amended) The method of claim 1, wherein connecting the additional information storage device to the LSA controller further comprises:

initializing the new disk to all binary zeroes so that the new disk can be included in the parity calculations without modifying the parity already on disk;

temporarily suspending accesses to a RAID 5 array controlled by the LSA controller and flushing any data cached by the RAID array prior to temporarily suspending access;



adding the new disk as a member of the RAID array; and  
applying an algorithm to optionally relocate the parity and/or the data.

12. (Currently Amended) A log structured array (LSA) controller comprising a logic device configured to control the transfer of information between a processor and a plurality of information storage devices in which the information is stored as a plurality of stripes extending across the plurality of storage devices of the array, and further configured upon the addition of a new information storage device to the array, to logically append to the end of each stripe in a directory a new strip provided for the new information storage device, the directory specifying storage locations using ~~relative addresses~~ a construct comprising a stripe number and an offset.

13. (Original) The LSA controller of Claim 12, wherein the plurality of information storage devices are configured as an N+1 array.

14. (Original) The LSA controller of Claim 12, wherein each stripe comprises N information strips and one parity strip, each information strip storing an integer number of logical tracks.

15. (Previously Amended) The LSA controller of Claim 12, wherein the directory further comprises an LSA directory specifying the location of a logical track in terms of the ID of the stripe to which the track belongs and the offset of the track within the stripe.

16. (Currently Amended) A log structured array (LSA) controller for adding an information storage device to a plurality of information storage devices in an information processing system in which a processor is connected for communication with the information storage devices by means of a log structured array (LSA) controller in which the information is stored as a plurality of stripes extending across the plurality of storage devices of the array, the LSA controller comprising:

a directory which specifies storage locations using ~~relative addresses~~ a construct comprising a stripe number and an offset;

means for connecting the additional information storage device to the LSA controller;  
and means for logically appending an additional strip provided to each existing stripe by the additional storage device to the end of each stripe in the directory.

17. (Previously Amended) The log structured array (LSA) controller of claim 16, further comprising means for configuring the plurality of information storage devices as an N+1 array.

18. (Previously Amended) The log structured array (LSA) controller of claim 16, wherein each stripe comprises N information strips and one parity strip, each information strip storing an integer number of logical tracks.

19. (Previously Amended) The log structured array (LSA) controller of claim 16, wherein the directory comprises a LSA directory which specifies the location of a logical track in terms of the ID of the stripe to which the track belongs and the offset of the track within the stripe.

20. (Currently Amended) An information storage system comprising:  
a plurality of information storage devices;  
a processor connected for communication with the information storage devices by means of a log structured array (LSA) controller in which the information is stored as a plurality of stripes extending across the plurality of storage devices ~~of the array~~,

an LSA controller comprising a directory which specifies storage locations using ~~relative addresses~~ a construct comprising a stripe number and an offset, the LSA controller configured to connect an additional information storage device to the LSA controller and logically append an additional strip provided to each existing stripe by the additional storage device to the end of each stripe in the directory.

21. (Original) The information storage system of claim 20, wherein the plurality of information storage devices comprise an  $N+1$  array.

22. (Original) The information storage system of claim 20, wherein each stripe comprises  $N$  information strips and one parity strip, each information strip storing an integer number of logical tracks.

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4. The following is an examiner's statement of reasons for allowance:

While the references separately teach adding an additional storage device to an array (Schultz et al. or Choy et al.) and an LSA directory storing a strip and offset (Brady et al.), the combination of references does not teach, suggest or provide motivation for "logically appending an additional strip provided to each existing stripe by the additional storage device to the end of each stripe in the directory" when connecting or adding an additional information storage device to an LSA controller, in combination with the other elements of the independent claims.

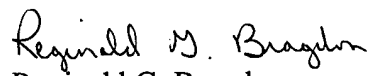
5. Any comments considered necessary by applicant must be submitted no later than the payment of the issue fee and, to avoid processing delays, should preferably accompany the issue fee. Such submissions should be clearly labeled "Comments on Statement of Reasons for Allowance."

6. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Reginald G. Bragdon whose telephone number is (571) 272-4204. The examiner can normally be reached on Monday-Thursday from 7:00 AM to 4:30 PM and every other Friday from 7:00 AM to 3:30 PM.

The examiner's supervisor, Mano Padmanabhan, can be reached at (571) 272-4210.

Any inquiry of a general nature or relating to the status of this application should be directed to the Group receptionist whose telephone number is (703) 305-3900.

RGB  
April 21, 2005

  
Reginald G. Bragdon  
Primary Patent Examiner  
Art Unit 2188